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ABSTRACT

Although teachers have been encouraged to use tradebooks as part of the science curriculum, not much is known about the factors--including teachers' assumptions--that influence the decisions about the books they choose to use. This paper explores some of these issues by asking groups of elementary school teachers to choose from a large set of science books they plan to use. The assumptions and findings of this study reveal some of the teachers' choices concerning science, children, and books. Reasons for these assumptions, their possible outcomes, and ways to move beyond them are also discussed. Contains 41 references. (CCM)

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Reading in Elementary Science Instruction: An Examination Of Teachers' Trade Book Selections

Given the task of choosing from a set of books that would enhance her science instruction on the topic properties of matter, Lisa*, a first grade teacher, selected the "First Discovery" book The Earth and Sky as her top choice, citing the "[clear, plastic] overlays and not too much information for their short attention spans" as her reasons. Her second choice, Gail Gibbons' Planet Earth/Inside Out is a much more complex text. Kim commented, "the author is great, the diagrams, information, and map are excellent! But I would not use for first grade—it's too long. It would be great, though, for higher grades." Her third choice, Seymour Simon's Mountains, received similar acclaim, but was once again dismissed as "too long and difficult for young children". Completing the task, Lisa selected three books from the "Let's Explore Science" series, books that include photographs of young children engaged in science activities, information about the topic, and instructions for topic-related activities. She concluded that these books "would be great at interest centers for enrichment."

There are assumptions underlying Kim's decisions about books that are appropriate for first grade science instruction. Even though teachers have been encouraged for some time to use trade books as part of the science curriculum (Barlow, 1991; Butzow & Butzow, 1988; Mayer, 1995; Smardo, 1982), we do not know much about the factors, including teachers' assumptions, that influence teachers' decisions about the books they choose to use. To explore some of these issues, we asked a small group of elementary school teachers to choose from a large set of science books those they felt would enhance their science curriculum on particular topics. We also asked them to provide their reasons for their selections. This paper reports on the findings of that study, revealing some of the assumptions concerning science, children, and books that

underlie these teachers' selections. From these findings, we discuss the assumptions, their possible outcomes, and ways to move beyond them.

Background and Purpose of the Study

The present study arose from the exploration of the relationships of textbooks and trade books in the area of science instruction. Literature from the fields of reading research and science instruction is reviewed in the following sections.

The Cry against Textbooks

Though textbooks have long dominated science instruction (e.g., Weiss, 1987), children reaching the upper elementary grades often have a difficult time comprehending these texts (e.g., Armbruster & Anderson, 1988; Beck, McKeown, Hamilton, & Kucan, 1997; Casteel & Isom, 1994). Beck and colleagues (1997), following research lines established in the mid 1980's (e.g., Armbruster & Anderson, 1985, 1988), explain that children's difficulties have much to do with the "inconsiderate" nature of content area texts -- information too densely packed, too much assumed prior knowledge, too many missing cohesive connections, and too much irrelevant information included.

Not only do critics address "inconsiderate" text in textbooks, they also stress the lack of appeal to child readers. For example, Moss (1991) explains that textbooks are unappealing to students and "fail to arouse student interest" (p.) In their attempts to respond to criticisms, textbook companies appear to have created other complexities. Walpole's (1998/1999) study indicated that newly published science basals' layout of text on pages designed to be more "eye-catching" caused confusions for child readers.

Beyond the problems with the texts themselves, there are other limitations to traditional textbook science instruction (Armbruster, 1992-1993). Certainly, the use of a single text per

grade level makes it difficult to differentiate instruction. Many teachers, possibly insecure in their own science content and/or pedagogical content knowledge (e.g., Czerniak & Lumpe, 1996; Harlen, 1997; Tilgner, 1990) rely solely upon the textbook, to the exclusion of related activities and experiences (Weiss, 1987).

In fact, these difficulties with and limitations of textbook-based science instruction, along with teachers' lack of confidence in knowledge of and/or ability to teach science, and children's perceived disinterest and poor achievement in science led to the National Science Foundation's (1989) Project 2061. Designed to heighten interest in science by changing the nature of elementary science instruction, suggestions from that project included integrating children's literature (and reading and writing) into the science curriculum.

Science Instruction beyond the Textbook

This suggestion was not met with universal applause. In fact, the director of Project 2061, F. James Rutherford (1991) explained his personal position on the place of books in the science curriculum.

> The learning of science begins with a child's personal experience of his world, not someone else's interpretation. It begins with questions, not answers; with finding out, not being told; with butterflies and Tinkertoys, not books. (p. 21)

Others, participating in the same Children's Literature Center of the Library of Congress symposium, stood firmly against Rutherford's activity-based, discovery-oriented view of science teaching. Roth (1991), advocating for the place of science trade books in a conceptual change model of science instruction, retorted, "Such an activity-focused, discovery approach to teaching the subject does not in itself provide enough guidance to help most children figure out the language, rules, and ways of thinking in the [science]

neighborhood" (p. 159). Certainly, Roth's position would receive considerable support from those who focus on the discourse of science (e.g., Halliday & Martin, 1995; Martin & Veel, 1998).

Books and Science Instruction

Recent research in the field of reading appears to support Roth's position, not Rutherford's (Anderson, 1998: Guthrie et al., 1998; Morrow, Pressley, Smith, & Smith, 1997). Morrow and her colleagues (1997), for example, found that children in the children's literature + science activities group scored higher on posttests of science facts and vocabulary than did children from either the children's literature only group or the control group. Guthrie and his colleagues (1998), creators of the Concept-Oriented Reading Instruction program that utilized trade books and science activities, found that students in the CORI program had a greater increase in strategy use and text comprehension than students who did not participate in the program. Anderson (1998) extended the CORI efforts, finding, as did Morrow et al. (1997), that students participating in the science observations + interesting texts experimental treatment gained more conceptual knowledge than any other condition

The Tricks of the Trade Books

Given results supporting the use of children's literature as well as the many problems associated with trade books, it is little wonder that many have simply decided to call for the replacement of textbooks with trade books (e.g., Barlow, 1991; Butzow & Butzow, 1988; Kosmoski, 1980; Mayer, 1995; Smardo, 1982). This, however, leads to two important questions: What kinds of trade books should be used in science instruction? In what ways should they be used?

Many, for various reasons, advocate the use of fiction in science instruction. Some have adopted a position that the first literature used must be stories; this genre is assumed to be more likely to draw children into the topic to be studied (Lake, 1993; McClure & Zitlow, 1991), resulting in a lesser likelihood that their interest will be "turn[ed] off" (Keys, 199?). For example, Lake (1993) has suggested "an effective science program uses picture [story] books as a way to instill a love of science in students and enhances and extends their message through adding information books" (p.73). Similarly, McClure and Zitlow (1991) suggest that only when children are encouraged to take an aesthetic stance to ideas presented in science, through poetry and fiction, do they "combat [the] meaninglessness" (p.) of facts presented in non-aesthetic ways. Still others simply state "It's hard to read aloud without a story line"

This story first stance raises objections from three different fields of study. Literary studies, science education, and research in children's interactions with and comprehension of informational texts each offer an alternative view.

What Is the Proper Place of Literary Works in the Classroom?

Rosenblatt, writing in 1991, worried about the way children would learn to engage with different types of texts.

> "[T]eachers ... need to be clear theoretically about efferent and aesthetic reading. As they commendably seek to present more "literature" in their language arts curricula, they need to be careful not to "use" the appeal of such texts simply or mainly for the efferent purposes of teaching grammar or 'skills' [or facts]. Also, as teachers plan to include aesthetic elements in the work in social or natural science or to utilize the interest of story in the teaching of mathematics, they need

to realize that they have a responsibility not to create confusion about primary stances appropriate to the different purposes. (p. 447)

Just the Facts, Please: Science Educators Voice Concerns With Fiction

From the perspective of science education, Mayer's (1995) study of the read aloud of Dr. Mr. Blueberry and its influence on science knowledge growth for her kindergarten through 3rd grade sample represents a related area of concern. Children did not demonstrate retention of much new information, and even picked up misinformation, leading Mayer to caution against the use of fictional children's literature that has not carefully been considered for accuracy and presentation.

Rice and Rainsford (1996) followed Mayer's concern with accuracy by examining a corpus of 300 trade books to get a sense of misconceptions children might acquire. In a sample that contained information books, fantasy and realistic fiction, Rice and Rainsford found misconceptions primarily in the stories, but they noted, information books also occasionally could lead readers astray. They suggested that teachers choose books carefully, yet acknowledged that their lack of science content knowledge may result in misconceptions being overlooked and then not even addressed.

How Do Readers Interact With Informational Texts?

Three distinct, but related, lines of research on genre in the field of reading have addressed this question. These three types of studies have focused on 1) young children's ability to "retell" information books, 2) the unique aspects of informational storybooks, and 3) children's interactions with information books during read alouds.

Retelling information books. In the late 1980's, researcher Christine Pappas, began exploring the generic shape of a particular subgenre of information books. These books dealt

with a particular topic, such as tunnels. While the texts might contain some passages in which the element of time, so crucial to the "and then... and then... and then..." structure of narrative, figured importantly, the text in its entirety was not time linked. Noting certain linguistic features of these texts, Pappas (e.g., 1991, 1993) sought to examine whether kindergarten children could, in fact, retell informational texts employing these features. Pappas found that not only could the children retell the texts that they had heard, but also they did so successfully employing features she termed co-referentiality and co-classification. She also noted that, of the texts she used in her study, her kindergarten subjects preferred the information book to the storybook.

Duke and Kays (1998), who studied 20 preliterate kindergarten children's abilities to retell wordless information books, later extended Pappas's work. The children, hearing information books read aloud frequently from the period from September to December were seen as incorporating more of the critical linguistic features, earlier identified by Pappas, as their exposure to information books increased.

The informational storybook: Its influence on readers' attention to science content. Influenced by Pappas, Leal (1993) called attention to what she termed a "grey" genre -- the informational storybook. Such texts, like the popular "Magic School Bus" books, may be seen as "fuzzy" (Pappas, Kiefer, & Levstik, 199) because authors have combined features from both story and information books to specifically create a product that will provide information in a fiction-based format. Because many texts may to some degree be classified as fuzzy (for instance, Joyce's Ulysses may be seen as supplying considerable information on Dublin), we have chosen to term these books *dual purpose* (DP) to indicate that the author intended to present facts but to do so in a fashion that would be humorous and entertaining for children.

The question of text type and its relationship to growth in conceptual knowledge has proven of interest to various reading researchers. Leal (1991) found that when first, third, and fifth grade children discussed an informational storybook, they had better discussions, as determined by length of time on topic, building on peer response, number of speculations provided, and discussion of related topics, than they did following a story or an informational book. She also found that more information was retained.

Others, however, have found the narrative elements of the story impede students' learning of information supplied within a story (Jetton, 1994; Maria & Junge, 1994). Maria and Junge did not give children a purpose for reading an informational story or the expository passage from a science textbook assigned to different groups of fifth graders. They found that children were more interested in the "Magic School Bus" book than the textbook passage, but that neither led to greater retention of informational ideas. Jetton (1994) gave second graders one of two specific purposes as they were listening to the informational story Dear Mr. Blueberry. One group was to listen to a story about a little girl; the other group was to listen for information in a book that told about the life of whales. For both groups, regardless of what children were told to listen for, recalled ideas were predominately emotional response or attention to story aspects, not information.

Engaging with information books during read alouds. In her 1991 paper, Pappas explained that the teachers she had spoken with during her study believed that children, in general, prefer stories to information books. Chittenden (1991), studying the role of science books in primary grade classrooms, quoted one teacher as saying, "It's real hard to read aloud without a story line" (p. 137). Horowitz and Freeman (1995) studied the preferences of kindergarten and second grade students. They found that teacher-led discussions of books could

ultimately lead to children's preference for an informational text over a story text. Our own research (Smolkin & Donovan, in press) notes that first graders engage in more intensive discussion during the reading of information books than they do during the reading of picture storybooks.

Given these many studies representing conflicting points of view on the role of stories and informational texts, we wanted to understand how teachers thought about the texts they would use for science instruction in their classroom. This led us to create the study described in the next section.

Method

The Teachers and Setting

Participants were attending a half-day "Reading and Writing Science" workshop that was provided as one choice among several on the topic of science instruction. All teachers from the district (K-12) were in attendance at this mandatory full-day professional development meeting. The ten teachers (all females of European-American descent) who chose to attend the session taught in one of the elementary schools in a small rural school district in the Southeast. Each participant filled out a short, open-ended questionnaire to provide a sense of her current science instruction. The four primary grade teachers (2 first grade, 2 second grade) reported similar curricular approaches. Science kits were used by all four and supplemented with other materials, as one first grade teacher reported "I supplement the kits with trade books and other resources". Whereas the primary grade science instruction was centered on the activity-based kits, the intermediate grade teachers (2 third grade, 2 fourth grade, 2 fifth grade) centered their instruction around a science textbook. This is captured best by one of the fourth grade teacher's description

"I usually follow the outline of the text incorporating trade books, videos, experiments, etc., as I teach."

Materials

Two sets of books were compiled; one was on the topic of "Life Cycles" and the other the "Properties of Matter". These topics were chosen as ones that were typically taught in some manner across the elementary school grades. The books were chosen to represent a range of readability levels, complexity, features, and the three genres discussed (fictional story, informational story, narrative and non-narrative information book). We chose from available books that we have seen used by teachers for thematic units, listed in the GEMS (Great Explorations in Math and Science) guide to integrating children's literature into math and science, recently available early readers (e.g., Wright Group), and written by authors well known for their information books.

The book sets are presented in Tables 1 and 2. Genre, readability, number of pages with text, total number of words, average number of information ideas per page, and other features such as illustration type, are reported for each book in both sets. The genre of each book was considered non-narrative information (NN), narrative information (N), fictional story (S), dual purpose (DP), or poetry/language play (P/LP).

Insert Tables 1 and 2 about here

Reading level of the books was determined using the Fry Readability Formula. Content analysis included determining the number of informational ideas (Maria & Junge, 1994) as well as diagramming each book to show visually the hierarchical relationships (depth and breadth) among the content. Simple texts have very little breadth (introduce few ideas), and provide very

little depth (elaboration is minimal). Complex texts provide many ideas about the topic, or subtopics (greater breadth), and provide much more elaboration (greater depth) of these ideas. Some of the books had informational ideas implied in the text. These ideas may be thought of as holding potential for providing information or elaboration on a concept, but we saw them as effortful, in that teachers must go beyond what is written to make these ideas explicit for the children.

Data Collection and Analysis

The ten teachers were split into two groups, each with one teacher of each grade. Each group worked at a large table with one of the book sets for about thirty minutes. Then they switched and worked with the other book set. The task was "Choose books from the set that will enhance your science instruction of that topic." The task sheet asked them to make a single choice "if you could choose just one book which would it be? Why?" "If you could choose another book, which would it be and why?" and finally, "If you could have any combination of books in this set, which ones would you want for your science instruction on this topic?" We examined teachers' book choices for patterns across grades in the titles chosen, the reasons given, the genres selected, the content complexity, and other features that might emerge as important to teachers' consideration.

Results

Teachers' choices are first reported in terms of the actual books selected from each book set. Their reasons for their selections are then considered.

Teachers' Selections from the Book Sets

Teachers' choices from the two groups are shown in Table 3. The far left column provides the total number of selections for each title. The middle and right columns provide the

selection information for the "Life Cycle" and "Properties of Matter" book sets, respectively. The titles for each set are listed in descending order of popularity. For each title, the genre, readability, and average number of informational ideas per page are shown in parentheses. To the right of that are the grade levels of teachers who selected the book. For example, seven was the highest number of times that any book was selected. No "Life Cycle" book was chosen that often, but seven teachers did select "Planet Earth/Inside Out" (non-narrative, 6.5 readability level, and 7.7 informational ideas per page) from the "Properties of Matter" set. Those who selected the book (1, 3, 3, 4, 4, 5, 5) included one first grade teacher, both third grade teachers, both fourth grade teachers, and both fifth grade teachers.

Insert Table 3 about Here

"Life Cycle" Book Selections

The most frequently selected books from the "Life Cycle" set included the story The Tiny Seed (2.5 readability, .25 explicit, .5 implicit) information ideas per page), and four non-narrative titles from the Wright Group collection, which had a range of readabilities (PP-2.0) and informational ideas presented per page (1.0 – 5.8). First through fourth grade teachers selected these books.

The next most frequently selected books included the story, The Very Hungry Caterpillar (2.5 readability, .25 explicit, .75 implicit) information ideas per page), by teachers across the grades, and six information books. The information books were both narrative (4) and non-narrative (2), and ranged in readability level (2.0 - 4.5) and in information ideas presented per page (1.0 - 11.5).

The stories, though selected frequently by teachers across the grades, contained very little information about the concept of the life cycle. The Tiny Seed presented .25 informational ideas per page that were explicit and .5 that could be made explicit if the teacher took the time to do so. The Hungry Caterpillar also had an average of .25 informational ideas per page that were explicit and .75 that could be made explicit by the teacher. There does not appear to be a grade-level pattern in the selections of "Life Cycle" books as teachers across the grades selected both complex and simple books, in terms of readability and informational ideas that are included.

Properties of Matter Book Selections

The most frequently selected book was Gail Gibbons' Planet Earth/Inside Out, a non-narrative information book of 6th grade readability and an average of 7.7 informational ideas presented per page. Teachers at each grade except second selected this book. The Magic School Bus Inside the Earth, a dual purpose text with readability of 3.8 and an average of 6.0 information ideas per page, was selected second most frequently, and by teachers at all grade levels. A teacher at each grade level also selected The Earth and Sky, a non-narrative information book with 3.0 readability and an average of 3.5 information ideas per page.

Books selected three times each had a wide range of readability levels (1.8-7.0), average numbers of informational ideas presented per page ranged from .67 to 7.2. Two selections were non-narrative with photographs and two were considered dual purpose with color cartoon-like illustrations. Teachers across the grades selected these books; a grade level pattern was only apparent for Building Things, selected only by first and second grade teachers.

Two teachers chose Make it Balance and Make it Change, non-narrative books that ask questions in order to engage children in activities designed to lead to the discovery of concepts. These concepts, however, are not explicit in the text.

The Snowy Day, with its 1.8 readability and .67 information ideas per page, was selected by two second grade and one third grade teacher, but the other story, The Oobleck, was not selected by any teacher. There is no discernable grade-level pattern in teachers' selections of Properties of Matter books; teachers across the grades selected both complex and simple books, both in terms of readability and informational ideas that are included.

Overall Selections

Across both sets of books, teachers chose titles with a range of readability levels, features, and informational ideas presented. The three stories selected were similar in readability (1.8 - 2.5) and provided little information. The information in these stories is generally implicit; teachers, to use these as science texts, would need to move away from the plot line to make the science information explicit.

Teacher selections by genre for each set and overall were very close to the percentage of the genre that was available. For "Life Cycle" books, the availability of books was 9.1% story, 4.5% dual purpose, 18.2% narrative information, and 68.2% non-narrative information, as compared with the actual selections of 13.7%, 3.9%, 25.5, 56.9%, respectively. The "Properties of Matter" set had the following percentages of the different genres available: 14.3% story, 28.6% dual purpose, 0 non-narrative information, 57.9% non-narrative information. Selections were, again, similar to availability with 7.7% story, 33.3% dual purpose, and 59.0% non-narrative information.

Teachers' Comments about Their Selections

The reasons teachers gave for their choices of books are provided in Tables 4 and 5. Table 4 presents the books selected most frequently (3 to 5 times) from the "Life Cycle" book set along with the comments made by the teachers about their choices. Table 5 presents the

"Properties of Matter" books selected most frequently (3 to 7 times) with the teacher comments about those selections. In both tables, following the title and in parentheses, are the genre, readability level, and average informational ideas per page for the book.

Insert Tables 4 & 5 about here

Five patterns emerged from teachers' comments about what they consider important in their selections. These included a consideration of the content, attention to the photographs and illustrations, concern for the readability level and grade-level/developmental appropriateness, and the desire to include books that are "fun" and enjoyable. Teachers' reports of what they would do with the books they selected make up our final category.

Considering Content

Teachers at all grade levels mention content as a consideration in their selections. Many of the comments were very general as in "photos and information are great" (1st) and "the factual information is good" (3rd). Some are a little more specific including "a lot of concepts covered" (2nd), "good information and vocabulary" (3rd), and "the explanations are good" (5th). One first grade teacher chose the book Eggs, Larvae, and Flies because "[it shows] photographs of life cycle that isn't butterfly or frog". "Life Cycle" books range in complexity of informational ideas presented from .25 to 11.5. The low end represents the story selections The Tiny Seed and The Hungry Caterpillar as well as the very low readability Wright Group books, which range from 1.0 informational ideas per page to 5.8 per page. The range of average informational ideas per page for "Properties of Matter" selections was 2.5 to 7.7.

Attention to Photographs and Illustrations

Teachers at all grades also attended carefully to the books' photographs and illustrations. General comments for Gibbons' Planet Earth/Inside Out included "Great illustrations" (1st), "Great illustrations of the information" (3rd), "Great diagrams, map..." (1st). Only one teacher who chose the Wright Group books did not mention the "Good photographs" (4th), "colorful photographs" (1st), etc.

Spiders' Nest and Hornets' Nest, two books with step-cut pages revealing more and more of the animals' progression in their nest-building process, were selected by three teachers each; almost all mentioned the illustrations. For example, one commented "interesting presentation to show children the steps" (1st).

Concern for Readability and Grade-Level Appropriateness

Upper grade teachers mentioned the readability level of books they selected a total of thirteen times. Comments such as "Simple text and photographs for guided reading" (3rd), and "Pictures, easy text—great for lower level students" (4th) were typical comments. Most of these were made in response to the Wright Group books, designed by the company to be informational texts for very young readers. These texts were shorter than others with an average of 15 pages with text, and readability levels from PP to 3.0.

Whereas upper grade teachers were concerned with finding books appropriate for the reading levels of all of their students, primary grade teachers' were concerned with the developmental appropriateness of the books for their students. Comments such as "...simple to understand" (1st), "It's grade-level appropriate—second graders could understand", and "Presents material well for second grade", demonstrate this concern for the complexity of concepts and the conceptual ability of primary grade students.

Desire for Books that are "Fun"

A common theme appeared as teachers described their selections of all stories and dual-purpose books; repeatedly, these books were described as "more child-oriented, kids love these books" (4th). For all but one of the ten selections of a "Magic School Bus" book, teachers from every grade level produced a comment similar to "students enjoy these books and learn from them," (5th). A second grade teacher noted the appeal of the main character in her statement that "students love Ms. F and it's information in a fun way." References to both the "fun" nature of the books and the information/learning that would be involved occurred for all but one selection of the dual purpose books. For stories, however, comments were less likely to include direct reference to learning from the book experience. For five of the ten story selections, teachers focussed more on the enjoyable/appealing nature of the book; a third grade teacher commented about Carle's The Tiny Seed, "It's a fun story." A second grade teacher remarked, for both The Tiny Seed and The Very Hungry Caterpillar that the story was written in a manner that "second graders could understand."

Potential Use of the Books

Teachers across the grades mentioned a variety of uses for the books. These included reading them aloud, putting them at an interest center, adding them to the class library, using the book for guided reading, sharing the illustration, and making the book available for children to use for their own research projects. As regarded books to read aloud, teachers commented that all of the storybooks (Snowy Day, The Tiny Seed, The Very Hungry Caterpillar), all of the dual purpose books ("Magic School Bus" books, Quicksand, Popcorn) and the story-like narrative information book, Seasons of Arnold's Apple Tree, were "good to read aloud". Only two non-

narrative information books (Mountains, and Flowers, Fruits & Seeds) were considered by all those who selected them to be useful for reading aloud.

Other information books produced varied responses as to their best classroom use. For example, The Earth and Sky was considered good to read aloud by the first, second, third and fifth grade teachers who selected it; however, the fourth grade teacher who included it as one of her top picks saw its purpose as supporting children's individual research projects. Three of the seven teachers (1st, 3rd, 5th) who selected the most frequently chosen Planet Earth/Inside Out commented that they "would read aloud [it] and make [it] available to children". The other four teachers (3rd, 4th, 4th, 5th) saw the "as an extra resource" in the classroom. Similarly, the primary grade teachers who selected the "Let's Discover Science" books Building Things, Make it Change, and Make it Balance, responded that these books would work well in classroom science interest centers. Teachers also described these books as a teacher resource given, noting the "information for teachers and parents" section.

A few teachers commented that the Wright Group early reader books were good to read aloud. However, of their 19 selections of various books from this series, only four teachers suggested reading aloud as a possible use. Guided reading was indicated 13 times.

Discussion

Naturally, teacher selections and comments in this study were a direct result of the texts we supplied for them. What they chose and said might have looked quite different had we included larger numbers of stories or easy readers or narrative informational texts and so on. Still, given the research we had reviewed that described teachers' discomfort with the teaching of science, we found the teachers' selections and comments quite encouraging. Teachers were relying, as advised by many children's literature experts (e.g., Huck, Hepler, Hickman, & Kiefer,

1997), upon recognized science books writers in making their selections. Many of them were thinking about the many types of texts a good science section of a classroom library would contain -- some for read aloud, some for children to read to themselves, and so forth. These ten teachers, who had no particular training in selecting science books, seemed to have a good idea about features of texts to which they must attend in order to select trade books to enhance their science instruction. Content was most frequently mentioned, and teachers at every grade level did so. Teachers' also frequently mentioned the readability of texts. This was particularly true for those in upper grade settings in which many children are, for all the reasons noted earlier, unable to read the textbook. We believe this indicates that the teachers are seeing possibilities for those books to support science instruction by providing their students individual access to science concepts. Teachers also commented on the photographs and illustrations. Although they did not specifically indicate that they would use the photos in a particular way, perhaps as springboards for discussion, their attention to this visual aspect suggests to us that the teachers considered this an important part of the content. We also noted that teachers were not avoiding books dense in content. The three books from the "Properties of Matter" set that were selected most frequently had averages of 7.7, 6.0 and 2.5 informational ideas per page. Books selected from the "Life Cycle" set were not as dense in their presentation of information. This, however, was most likely due, to some degree, to the books we selected for this study. The very popular, low readability, Wright Group early reader books were not as dense in information as other books in our sample; average informational ideas across the most frequently selected of these texts ranged from .5 to 11.5 per page.

Still, there were certain teacher comments and trends that alerted us to underlying assumptions concerning science, children, and books. In the sections that follow, we discuss these assumptions, their possible outcomes, and ways to move beyond them.

Though the supplied worksheet for the book selection task had space to record many books, one of the fifth grade teachers selected only two books from the "Life Cycle" set. Both of these were stories. Her reason for selecting The Tiny Seed was "it shows the life cycle of plants", and her comment about the selection of The Very Hungry Caterpillar was "it shows the life cycle of the butterfly". Our analysis of these two stories shows them to be not only simplistic in informational complexity, but also inaccurate in the information they present. A very hungry caterpillar is shown eating his way through cakes, ice cream, salamis, muffins, etc. Of course, this is not what caterpillars eat, nor need it be, given that Carle was not writing a dual purpose text but instead was creating a fantasy. Finishing his fantastic meal, the caterpillar spins himself into a cocoon, not a chrysalis. Carle, confronted numerous times with the problem in nomenclature, finally explained on this website (http://www.eric-carle.com/cocoon.html) that he chose this term because his dad had used it to describe Eric as a child. As Carle explains, "Poetry won over science." The teacher's second choice, Carle's The Tiny Seed, also is a source of misinformation. Seeds, in fact, do not blow close to the sun and therefore do not face the danger of being burnt.

For fifth graders, even low ability fifth graders, reliance upon these two books alone to teach about the life cycle will not produce impressive science knowledge growth. Children of all ability levels need good models of the genres specific to science. Had the teacher been concerned only with readability, she could have selected the Wright Group book Egg, Larvae & Fly. This easy-to-read book contained five times the number of informational ideas per page.

However, this density of information may, in fact, been the very reason that the teacher chose the two stories, especially in the light of the "we gotta make science fun" stance we will discuss shortly.

Another area of great concern were the teachers' many selections of stories and dual purpose texts as being appropriate for read alouds; as we noted earlier, only two non-narrative books were noted as possibilities for read alouds. In fact, one of the two first grade teachers continually selected a range of information-packed, exemplary science books. In her comments, however, she wrote that she would not use the books for first graders; they were too long (could not be read at one sitting) and too difficult (in conceptual load).

The choices and comments bring us back to our earlier statement about teacher assumptions. What assumptions may underlie this stance? We propose that there is a minimum of two: "Science is boring; you've got to make it fun" and "It's impossible to read aloud a non-narrative science text and keep children's attention".

The "you gotta make science fun" assumption calls to mind the writing of children's literature critic Perry Nodelman. Writing on adult selections of literature for children, Nodelman (1992) stated that "[an] assumption about childhood that controls the ways in which children are presented with information is the conviction many adults have that children, being fun-loving creatures with little capacity for thought, find information boring" (p. 182). He went on to say, "'in believing that we have to make learning fun, we may actually be teaching children that it is no fun at all" (p. 182).

The truth is that children do not find science "unfun" at all. Our own examinations (Donovan, Smolkin, & Lomax, 1999) of first graders' free choice book selections has shown that children DO frequently choose to read informational texts. And, not only do they freely choose

science texts, but they very commonly share these selected texts in small groups in ways that even Louise Rosenblatt might term aesthetic experiences. Clearly enjoying themselves, as we have described elsewhere (Donovan, Smolkin, & Lomax, under review), children share their own experiences, knowledge, and feelings ("yucky spiders!") during these interactions with texts from the world of facts. Given that we know that children like science texts of all types, we are sure that the science is "unfun" notion initially resides in the heads of adults, not in the heads of children.

Teachers' repeated designation of stories and dual-purpose texts as the books that should be read aloud also seems to arise from their "unfun" notions. However, a growing number of researchers have noted that discussion-laden readings of information books are both enjoyable and thought-provoking as well as influential in the types of texts children consider to be good books. The key to successful read aloud lies in the word discussion. As Horowitz and Freeman (1995) have said, "discussion can play a powerful role in influencing preference, sense of difficulty, and understanding of the author's purpose when students are asked to process science texts" (p. 38). Having made this point, Horowitz and Freeman go on to ask, "are there certain types of discussions and questions that increase interest in and use of particular science books?" (p. 39).

Their answer, confirmed by others (Oyler, 1996; Smolkin & Donovan, in press), is that interaction during science read alouds is key. As we have discussed elsewhere (Smolkin & Donovan, in press), to be effective, these interactions during the read alouds of science books must allow children to contribute to the conversation easily, asking their questions, offering their comments freely. For many teachers, this interactive aspect of a read aloud can be very challenging (e.g., Pappas & Barry, 1997), but the result is conversations that increase children's

comprehension, their science knowledge, and their thinking in scientific ways (Smolkin & Donovan, in press).

We close this paper with one final caveat about the very much-loved, frequently selected dual-purpose texts. Our content analysis, like that of Maria and Junge (1994) before, indicated that most of the informational ideas are not found in the running text on the pages nor in the speech bubbles that frequently carry the story line. In one of our texts, Magic School Bus Inside a Beehive, the 9.0 average informational ideas per page, are found primarily in the pictures and diagrams (3.4/page) and reports (3.9/page), as compared to the running text (1.0/page) and speech bubbles (.74/page). These numbers clearly indicate that read alouds of these dual purpose texts that fail to read through pictures, diagrams, and inserted reports are far less effective science read alouds than those that do.

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